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Dundee Discussion Papers in Economics

Market Structure, Cost Asymmetries and Fiscal Policy Effectiveness

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Market Structure, Cost Asymmetries, and Fiscal Policy Effectiveness

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Abstract

Imperfectly competitive macroeconomic models typically assume a symmetric equilibrium with identical firms, despite the fact that most industries are characterised by substantial degrees of firm heterogeneity. We examine how inter-firm efficiency gaps affect fiscal policy effectiveness under monopolistic competition.

Key Words: monopolistic competition, cost asymmetries, fiscal policy, market structure

JEL Classification: L16, L13

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1. Introduction

Recent developments in macroeconomics have formalised the market-power foundations of macroeconomic policy effectiveness¹. All these studies assume a symmetric equilibrium with identical firms. Inter-firm differences in performance and market shares, however, are a distinguishing feature of real world industries, as reported for example by Cubbin and Geroski (1987), Mueller (1990) and Oulton (1998).

This paper shows how relaxing the special assumption of symmetry affects the standard conclusions on fiscal policy effectiveness under monopolistic competition. Within a simple macromodel, where monopolistically competitive firms are characterised by heterogeneous costs², we show that when incumbents are more efficient than entrants the efficiency gap between firms can be sufficiently large to reduce the fiscal multiplier significantly, or even make it negative. Section 2 outlines the model, Section 3 derives the effects of a balanced budget fiscal expansion and Section 4 concludes the paper.

2. The model

The basic structure of the model is similar to Dixon and Lawler (1996), with three types of agents: households, firms and a government.

2.1. Households

There are a large number of identical households each with (i) a homothetic utility over a composite, horizontally differentiated good C and leisure $(1-L^s)$, where L^s is labour supply and the time endowment is normalised to unity; and (ii) a CES sub-utility over varieties. The first stage of utility maximisation consists of choosing C and L^s to maximise $u(C, L^s) = C^{1-\alpha} (1-L^s)^\alpha$ subject to the budget constraint $PC = WL^s + \Pi - T$, where P is the consumer price index for the CES consumption quantity index C , W is the nominal wage

rate, Π is nominal profit share, and T is a lump-sum tax. The number of households is normalised to unity, and the resulting labour supply and consumption demand functions are given by,

$$L^s = 1 - \alpha \left(\frac{W + \Pi - T}{W} \right), \quad (1)$$

and

$$C = (1 - \alpha) \left(\frac{W + \Pi - T}{P} \right). \quad (2)$$

There is a continuum of potential varieties of the horizontally differentiated good indexed by $j \in [0, n]$. The interval $[0, n]$ represents the ‘mass’ of available varieties and for expositional simplicity henceforth n shall be referred to as the ‘number’ of varieties produced in the industry. The second stage of utility maximisation then is to choose c_j to maximise

$$C = \left(n^{(\lambda-1)/\varepsilon} \int_0^n (c_j)^{1-(1/\varepsilon)} dj \right)^{1/[1-(1/\varepsilon)]} \quad \text{subject to the constraint} \quad \int_0^n (P_j c_j) dj = PC, \quad \text{where } c_j \text{ and}$$

P_j are consumption and price of a typical variety j , $\varepsilon > 1$ is the elasticity of substitution between varieties, and the price index P is defined as

$$P = \left(n^{(\lambda-1)} \int_0^n (P_j)^{1-\varepsilon} dj \right)^{1/(1-\varepsilon)}, \quad (3)$$

where λ is a constant parameter that reflects the extent to which the CES quantity and price indices explicitly incorporate the so-called ‘love of variety’. $0 \leq \lambda \leq 1$, and $\lambda=0$ and $\lambda=1$ correspond to the two extreme cases of ‘no love’ and ‘maximum love’. It is straightforward to

show that the resulting demand for variety j , is $c_j = \left(\frac{P_j}{P} \right)^{-\varepsilon} (n^{\lambda-1} C)$ – see Benassy (1996) for details.

2.2. Government

Government consumption, G , consists of a composite index of the differentiated varieties produced in the economy which is assumed to be financed by the lump-sum tax T paid by households³. The government budget constraint is given by $\int_{j=0}^n (P_j g_j) dj = PG = T$, where we assume that the government pays the same price as that paid by consumers.

2.3. Firms

It follows from the above that the demand function facing a typical firm is

$$y_j = \left(\frac{P_j}{P} \right)^{-\varepsilon} (n^{\lambda-1} Y), \quad (4)$$

where y_j is private and public demand for the brand produced by the firm, $y_j = c_j + g_j$, and Y is the aggregate demand for output, $Y = C + G$.

Each firm uses an increasing returns to scale technology which gives rise to the incentive to specialise in the production of one single variety. Labour is assumed to be the only factor of production, and to be perfectly mobile between firms, so all firms pay a common wage rate, W . Setting $W=1$ (using leisure as the numeraire), the total cost function of a representative firm j is given by its labour demand, $L_j^d = \beta_j y_j + \phi$, where β_j and ϕ are constants denoting the marginal and fixed labour requirements, respectively. Departing from the existing literature, we assume that, whilst having identical fixed costs, firms differ in their labour productivity. This is captured by β_j being a firm-specific parameter according to which firms can be ranked.

A function $\rho(j)$ can be defined to capture this ranking. In particular, we (i) impose a strictly monotonic ranking and let $\rho'(j) > 0$ for all $j \geq 0$; (ii) assume that successive entrants are less efficient than incumbents; and (iii) use an efficiency distribution with only one firm

per efficiency level⁴. The endogenous determination of the equilibrium mass of firms will entail the determination of the industry '*efficiency cut-off point*', i.e. the efficiency of the marginal firm in the industry. Given the assumed distribution, a larger equilibrium number of firms will correspond to a higher marginal cost of the marginal firm in the industry and to a lower average industry efficiency. The effects of entry in this model are consistent with some of the empirical evidence reported in the literature (see the studies in Mayes, 1996).

Each firm j chooses its price P_j to maximise its profit $\Pi_j = P_j y_j - (\beta_j y_j + \phi)$, subject to the demand function in (4). This implies the following optimal price rule $P_j = \left(\frac{\varepsilon}{\varepsilon - 1} \right) \beta_j$. Normalising the marginal cost by letting $\beta_j = \left(\frac{\varepsilon - 1}{\varepsilon} \right) \rho(j)$, implies the optimal pricing policy

$$P_j = \rho(j) \quad (5)$$

Clearly, this suggests that - for any given market structure - the industry is characterised by an asymmetric equilibrium spectrum of prices, quantities, market shares and profits distributed according to the value of $\rho(j)$, with lower cost firms having larger market shares and higher profits.

3. General equilibrium and the effects of a balanced budget fiscal expansion

Market structure is determined endogenously. Because in equilibrium there should be no new entry or exit, the last firm ($j=n$) will break even. Hence $\Pi_n = 0$ and ρ_n defines the cost efficiency of the least efficient, or '*marginal*', firm and thus represents the industry '*efficiency cut-off point*'. Clearly, $\Pi_j > 0$ for all $j < n$ since all firms whose marginal cost is lower than $\frac{\varepsilon - 1}{\varepsilon} \rho_n$ will make positive profits. Thus, contrary to the standard model, firm heterogeneity

implies that positive profits persist in equilibrium for the non-marginal firms. Using (4) and (5), the marginal firm zero-profit condition implies,

$$\left(\frac{P_n}{P}\right)^{1-\varepsilon} (n^{\lambda-1} PY) = \phi \varepsilon. \quad (6)$$

The total industry profit is $\Pi = \int_{j=0}^n \Pi_j dj$ which, using (5), implies $\Pi = \frac{PY}{\varepsilon} - \phi n$.

Also, in equilibrium both product and labour markets should clear. We have already incorporated the product market equilibrium condition. Labour market equilibrium requires

equating the labour supply given by (1) with total labour requirement, namely $L^s = \int_{j=0}^n L_j^d dj$.

To obtain explicit solutions, we assume an explicit functional form for the efficiency ranking function, that is $\rho(j)=j^\delta$, with $\delta \geq 0$, which satisfies our requirement; the size of δ determines the degree of firms' heterogeneity and the symmetric case is characterised by $\delta=0$.

The model can be reduced to the following three equations,

$$P = [1 - \delta(\varepsilon - 1)]^{1/(\varepsilon-1)} n^{\frac{\lambda - \delta(\varepsilon-1)}{\varepsilon-1}}, \quad (7)$$

$$\left(1 - \frac{1-\alpha}{\varepsilon}\right) PY - \alpha PG + (1-\alpha)\phi n = 1 - \alpha, \quad (8)$$

and

$$n^{\lambda - \delta(\varepsilon-1) - 1} P^\varepsilon Y = \phi \varepsilon. \quad (9)$$

Equations (7)-(9) correspond, respectively, to the price index in (3), the goods market equilibrium condition $Y = C + G$, and the marginal firm's zero profit condition in (6) into which we have substituted for the rest of the endogenous variables from the other equations. Note that we have used $\rho(j)=j^\delta$ and imposed the condition $1 - \delta(\varepsilon-1) > 0$.

Let $(\bar{Y}, \bar{n}, \bar{P}; \bar{G})$ denote the initial equilibrium⁵ and suppose that $\bar{G} = \gamma \bar{Y}$, $0 < \gamma < 1$.

The effects of a balanced budget fiscal expansion are given by the following

$$\frac{dY}{dG} = \frac{\alpha}{\alpha\gamma + \left(\frac{\varepsilon - 1}{\lambda + (1 - \delta)(\varepsilon - 1)} \right) \left((1 - \alpha\gamma) - (1 - \alpha) \left(\frac{\delta(\varepsilon - 1)}{\varepsilon} \right) \right)}, \quad (10)$$

$$\frac{dn}{dG} = \left(\frac{\varepsilon - 1}{\lambda + (1 - \delta)(\varepsilon - 1)} \right) \left(\frac{\bar{n}}{\bar{Y}} \right) \frac{dY}{dG}, \quad (11)$$

and

$$\frac{dP}{dG} = - \left(\frac{\lambda - \delta(\varepsilon - 1)}{\lambda + (1 - \delta)(\varepsilon - 1)} \right) \left(\frac{\bar{P}}{\bar{Y}} \right) \frac{dY}{dG}. \quad (12)$$

Upon examination (10)-(12) imply that: **(1)** dY/dG depends positively on λ and negatively on δ ; **(2)** $dY/dG > 0$ as long as $\lambda - \delta(\varepsilon - 1) \geq 0$. In this case, a fiscal expansion leads to entry since $dn/dG > 0$, and the price level falls. P is affected by **(i)** the mass of varieties and **(ii)** the efficiency composition of the industry. When $\lambda > 0$, an increase in n directly reduces the price index. Entry, however, reduces the average efficiency of the industry and results in ceteris paribus increases in P . Thus, for $\lambda - \delta(\varepsilon - 1) > 0$ the ‘love of variety’ effect dominates the ‘firms’ heterogeneity’ effect and $dP/dG < 0$ when $dY/dG > 0$. The sufficient condition for a negative multiplier, $\frac{dY}{dG} < 0$, can be derived from (10)⁶ and is given by

$$1 + \frac{\lambda}{\varepsilon - 1} < \delta < \frac{1 + \alpha\gamma\lambda / (\varepsilon - 1)}{\alpha\gamma + (1 - \alpha)(1 - 1/\varepsilon)}. \text{ Thus:}$$

Proposition 1: The balanced budget fiscal multiplier is more likely to be positive the larger are ε and λ and the smaller is δ

A high love of variety (large λ) and a low monopoly power of firms (large ε) will offset the increase in P resulting from the entry induced deterioration of the cost efficiency composition of the industry. For sufficiently small values of ε and λ , the latter effect will dominate, leading to a negative multiplier⁷.

In the basic setting considered by the existing literature, where there is no “love of variety” ($\lambda=0$) and firms are homogeneous ($\delta=0$), (10)-(12) respectively reduce to $\frac{dY}{dG} = \alpha$,

$$\frac{dn}{dG} = \left(\frac{\bar{n}}{\bar{Y}} \right) \frac{dY}{dG} \text{ and } \frac{dP}{dG} = 0 \text{ which correspond to the long-run case explained in Startz (1989).}$$

The output multiplier is a positive constant below unity, it is solely determined by households’ preferences and is independent of the elasticity of substitution between varieties (ε) and the initial size of the government (γ). With homogenous firms, entry does not affect the cost efficiency composition of the industry. Thus, given the absence of love of variety, a fiscal expansion - whilst inducing entry - will not affect the price index,

Instead, introducing love of variety and abandoning the assumption of identical firms implies that while the multiplier **may** remain positive, its size becomes dependent on α , ε , γ and δ . In particular,

$$\frac{dY}{dG} \geq 1 \text{ as } \lambda - \delta(\varepsilon - 1) \geq \frac{(1-\alpha)(\varepsilon-1)(\varepsilon-\delta)}{\alpha(1-\gamma)\varepsilon}, \text{ and } \frac{dY}{dG} \begin{cases} > \alpha \\ = \alpha \\ < \alpha \end{cases} \text{ as } \lambda \begin{cases} > \delta(\varepsilon-1)\theta \\ = \delta(\varepsilon-1)\theta \\ < \delta(\varepsilon-1)\theta \end{cases},$$

$$\text{where } \theta = 1 - \frac{(1-\alpha)(1-1/\varepsilon)}{1-\alpha\gamma}, \quad 0 < \theta < 1.$$

Proposition 2: The output multiplier will exceed unity if the ‘love of variety’ effect more than compensates the ‘inefficient entry’ effect.

Otherwise, there will be some degree of crowding out and it is in fact possible for the output multiplier to fall even below that obtained in the basic case.

4. Summary and Conclusions

The effects of fiscal policy under monopolistic competition are not neutral to the inter-firm homogeneity assumption which currently dominates the literature and relaxing this assumption is likely to raise interesting theoretical issues. Within a model which allows for

as direct a comparison as possible with the existing literature, we show that - when incumbents are less efficient than entrants - the efficiency gap between firms significantly reduces the effectiveness of fiscal policy.

New avenues for research naturally suggest themselves. Inter-firm heterogeneity questions the plausibility of assuming away strategic interactions between firms. Given the persistence of supernormal profits in the long-run, interesting results may stem from comparing the short-run and the long-run effects of government policy. Most importantly, the market structure effects of fiscal policy points towards the need to investigate the interaction of macroeconomic and industrial policy.

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Notes

¹ See for instance Mankiw (1988), Startz (1989), Molana and Moutos (1989, 1992), Dixon and Lawler (1996) and Torregrosa (1998).

² See Montagna (1995) for the market structure effects of firm heterogeneity under monopolistic competition.

³ Proportional income taxation is analysed in Molana and Moutos (1992) and Heijdra *et al.* (1998). We follow the standard textbook convention and do not consider agents' benefit from G . See Molana and Moutos (1989), Startz (1989), Reinhorn (1998) and Heijdra *et al.* (1998) for alternatives which allow for 'useful' government expenditure.

⁴ One could easily extend this to allow for a 'mass' of firms to exist per type but this would not affect the qualitative nature of the results.

⁵ It can be easily shown that (7)-(9) yield a unique solution.

⁶ From (10), the necessary, but not sufficient, condition for $dY/dG < 0$ is $\lambda + (1-\delta)(\varepsilon-1) < 0$. Thus, we need λ , ε and δ to satisfy: $0 < \lambda \leq 1$; $\varepsilon > 1$; and $1 + \lambda/(\varepsilon-1) < \delta < 1/(\varepsilon-1)$ which requires $1 < \varepsilon < 2 - \lambda$.

⁷ Clearly, the likelihood of the multiplier being negative will be *ceteris paribus* higher when $\lambda = 0$.